CHEMISTRY

1. Which of the following is not an ore of magnesium?
   1) Carnallite  
   2) Dolomite  
   3) Calamine  
   4) Sea water

2. The atomic numbers of Ni and Cu are 28 and 29 respectively. The electron configuration
   \(1s^2 \ 2s^2 \ 2p^6 \ 3s^2 \ 3p^6 \ 3d^{10}\) represents
   1) \(Cu^+\)  
   2) \(Cu^{2+}\)  
   3) \(Ni^{2+}\)  
   4) \(Ni\)

3. In the following, the element with the highest ionisation energy is
   1) \([Ne]3s^2 \ 3p^1\)  
   2) \([Ne]3s^2 \ 3p^3\)  
   3) \([Ne]3s^2 \ 3p^2\)  
   4) \([Ne]3s^2 \ 3p^4\)

4. In the conversion of \(Br_2\) to \(BrO_3^-\), the oxidation number of Br changes from
   1) zero to +5  
   2) +1 to +5  
   3) zero to −3  
   4) +2 to +5

5. Among the alkali metals cesium is the most reactive because
   1) its incomplete shell is nearest to the nucleus  
   2) it has a single electron in the valence shell  
   3) it is the heaviest alkali metal  
   4) the outermost electron is more loosely bound than the outermost electron of the
      other alkali metals.

(Space for Rough Work)
6. Which of the following represents the Lewis structure of \( N_2 \) molecule?

1) \( \cdot N \equiv N \cdot \)

2) \( \cdot N \equiv N \cdot \)

3) \( \cdot \cdot \cdot N \equiv N \cdot \)

4) \( \cdot \cdot \cdot N \equiv N \cdot \)

7. Hydrogen bond is strongest in

1) \( S-H \cdots O \)

2) \( O-H \cdots S \)

3) \( F-H \cdots F \)

4) \( O-H \cdots N \)

8. The decomposition of a certain mass of \( CaCO_3 \) gave 11.2 dm\(^3\) of \( CO_2 \) gas at STP. The mass of \( KOH \) required to completely neutralise the gas is

1) 56 g

2) 28 g

3) 42 g

4) 20 g

9. The density of a gas is 1.964 g dm\(^{-3}\) at 273 k and 76 cm Hg. The gas is

1) \( CH_4 \)

2) \( C_2H_6 \)

3) \( CO_2 \)

4) \( Xe \)

10. 0.06 mole of \( KNO_3 \) solid is added to 100 cm\(^3\) of water at 298 k. The enthalpy of \( KNO_3_{aq} \) solution is 35.8 kJmol\(^{-1}\). After the solute is dissolved the temperature of the solution will be

1) 293 k

2) 298 k

3) 301 k

4) 304 k

(Space for Rough Work)
11. 4 moles each of $SO_2$ and $O_2$ gases are allowed to react to form $SO_3$ in a closed vessel. At equilibrium 25% of $O_2$ is used up. The total number of moles of all the gases present at equilibrium is

1) 6.5  
2) 7.0  
3) 8.0  
4) 2.0

12. An example for autocatalysis is

1) oxidation of $NO$ to $NO_2$  
2) oxidation of $SO_2$ to $SO_3$  
3) decomposition of $KClO_3$ to $KCl$ and $O_2$  
4) oxidation of oxalic acid by acidified $KMnO_4$

13. During the fusion of an organic compound with sodium metal, nitrogen of the compound is converted into

1) $NaNO_2$  
2) $NaNH_2$  
3) $NaCN$  
4) $NaNC$

14. Identify the product $Y$ in the following reaction sequence

\[ CH_2-CH_2-COO \xrightarrow{Ca, \text{ heat}} X \xrightarrow{Zn-Hg, \text{ HCl, heat}} Y \]

\[ CH_2-CH_2-COO \]

1) pentane  
2) cyclobutane  
3) cyclopentane  
4) cyclopentanone

15. The reaction $C_2H_5ONa + C_2H_5I \rightarrow C_2H_5OC_2H_5 + NaI$ is known as

1) Kolbe's synthesis  
2) Wurtz's synthesis  
3) Williamson's synthesis  
4) Grignard's synthesis

(Space for Rough Work)
16. $\Delta G^0$ Vs T plot in the Ellingham's diagram slopes downwards for the reaction

1) $Mg + \frac{1}{2}O_2 \rightarrow MgO$
2) $2Ag + \frac{1}{2}O_2 \rightarrow Ag_2O$
3) $C + \frac{1}{2}O_2 \rightarrow CO$
4) $CO + \frac{1}{2}O_2 \rightarrow CO_2$

17. Which of the following reaction taking place in the Blast furnace is endothermic?

1) $CaCO_3 \rightarrow CaO + CO_2$
2) $2C + O_2 \rightarrow 2CO$
3) $C + O_2 \rightarrow CO_2$
4) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

18. Liquor ammonia bottles are opened only after cooling. This is because

1) it is a mild explosive
2) it is a corrosive liquid
3) it is a lachrymatory
4) it generates high vapour pressure

19. The formation of $O_2^+ [P^+_1 F_6]^-$ is the basis for the formation of Xenon fluorides. This is because

1) $O_2$ and $Xe$ have comparable sizes
2) both $O_2$ and $Xe$ are gases
3) $O_2$ and $Xe$ have comparable ionisation energies
4) $O_2$ and $Xe$ have comparable electronegativities

20. The highest magnetic moment is shown by the transition metal ion with the configuration

1) $3d^2$
2) $3d^5$
3) $3d^7$
4) $3d^9$

(Space for Rough Work)
21. A transition metal ion exists in its highest oxidation state. It is expected to behave as
   1) a chelating agent  2) a central metal in a coordination compound
   3) an oxidising agent  4) a reducing agent

22. In which of the following complex ion, the central metal ion is in a state of $sp^3d^2$ hybridisation?
   1) $[CoF_6]^{3-}$  2) $[Co(NH_3)_6]^{3+}$
   3) $[Fe(CN)_6]^{3-}$  4) $[Cr(NH_3)_6]^{3+}$

23. Which of the following can participate in linkage isomerism?
   1) $NO_2^-$  2) $H_2\tilde{N}CH_2CH_2\tilde{N}H_2$
   3) $H_2O$  4) $:NH_3$

24. Which of the following has the highest bond order?
   1) $N_2$  2) $O_2$
   3) $He_2$  4) $H_2$

25. Which of the following is diamagnetic?
   1) $H_2^+$  2) $O_2$
   3) $Li_2$  4) $He_2^+$

(Space for Rough Work)
26. The concentration of a reactant $X$ decreases from 0.1 M to 0.025 M in 40 minutes. If the reaction follows first order kinetics, the rate of the reaction when the concentration of $X$ is 0.01 M will be

1) $1.73 \times 10^{-4} M$ min$^{-1}$
2) $3.47 \times 10^{-4} M$ min$^{-1}$
3) $3.47 \times 10^{-5} M$ min$^{-1}$
4) $1.73 \times 10^{-5} M$ min$^{-1}$

27. Chemical reactions with very high $E_a$ values are generally

1) very fast
2) very slow
3) moderately fast
4) spontaneous

28. Which of the following does not conduct electricity?

1) fused NaCl
2) solid NaCl
3) brine solution
4) Copper

29. When a quantity of electricity is passed through $CuSO_4$ solution, 0.16 g of Copper gets deposited. If the same quantity of electricity is passed through acidulated water, then the volume of $H_2$ liberated at STP will be [Given At.Wt. $Cu = 64$]

1) 4.0 cm$^3$
2) 56 cm$^3$
3) 604 cm$^3$
4) 8.0 cm$^3$

30. Solubility product of a salt $AB$ is $1 \times 10^{-8} M^2$ in a solution in which the concentration of $A^+$ ions is $10^{-3} M$. The salt will precipitate when the concentration of $B^-$ ions is kept

1) between $10^{-8} M$ to $10^{-7} M$
2) between $10^{-7} M$ to $10^{-6} M$
3) $> 10^{-5} M$
4) $< 10^{-6} M$

(Space for Rough Work)
31. Which one of the following condition will increase the voltage of the cell represented by the equation: \( \text{Cu}_\text{(s)} + 2\text{Ag}^+_{\text{aq}} \rightleftharpoons \text{Cu}^{2+}_{\text{aq}} + 2\text{Ag}_\text{(s)} \)

1) increase in the dimensions of Cu electrode
2) increase in the dimensions of Ag electrode
3) increase in the concentration of Cu\(^{2+}\) ions
4) increase in the concentration of Ag\(^+\) ions

32. The pH of 10\(^{-8}\) M HCl solution is

1) 8
2) more than 8
3) between 6 and 7
4) slightly more than 7

33. The mass of glucose that should be dissolved in 50 g of water in order to produce the same lowering of vapour pressure as is produced by dissolving 1 g of urea in the same quantity of water is

1) 1 g
2) 3 g
3) 6 g
4) 18 g

34. Osmotic pressure observed when benzoic acid is dissolved in benzene is less than that expected from theoretical considerations. This is because

1) benzoic acid is an organic solute
2) benzoic acid has higher molar mass than benzene
3) benzoic acid gets associated in benzene
4) benzoic acid gets dissociated in benzene

35. For a reaction to be spontaneous at all temperatures

1) \( \Delta G \) and \( \Delta H \) should be negative
2) \( \Delta G \) and \( \Delta H \) should be positive
3) \( \Delta G = \Delta S = 0 \)
4) \( \Delta H < \Delta G \)

(Space for Rough Work)
36. Which of the following electrolyte will have maximum flocculation value for $Fe(OH)_3$ sol.?

1) $NaCl$  
2) $Na_2S$  
3) $(NH_4)_3PO_4$  
4) $K_2SO_4$

37. For a reversible reaction: $X(g) + 3Y(g) \rightleftharpoons 2Z(g)$

$\Delta H = -40 \text{kJ}$ the standard entropies of $X, Y$ and $Z$ are 60, 40 and 50 JK$^{-1}$ mol$^{-1}$ respectively. The temperature at which the above reaction attains equilibrium is about

1) $400 \text{ K}$  
2) $500 \text{ K}$  
3) $273 \text{ K}$  
4) $373 \text{ K}$

38. The radii of $Na^+$ and $Cl^-$ ions are 95 pm and 181 pm respectively. The edge length of $NaCl$ unit cell is

1) $276 \text{ pm}$  
2) $138 \text{ pm}$  
3) $552 \text{ pm}$  
4) $415 \text{ pm}$

39. Inductive effect involves

1) displacement of $\sigma$ electrons  
2) delocalisation of $\pi$ electrons  
3) delocalisation of $\sigma$ electrons  
4) displacement of $\pi$ electrons

40. The basicity of aniline is less than that of cyclohexylamine. This is due to

1) $+R$ effect of $-NH_2$ group  
2) $-I$ effect of $-NH_2$ group  
3) $-R$ effect of $-NH_2$ group  
4) hyperconjugation effect

(Space for Rough Work)
41. Methyl bromide is converted into ethane by heating it in ether medium with
   1) Al
   2) Zn
   3) Na
   4) Cu

42. Which of the following compound is expected to be optically active?
   1) \((CH_3)_2CHCHO\)
   2) \(CH_3CH_2CH_2CHO\)
   3) \(CH_3CH_2CHBrCHO\)
   4) \(CH_3CH_2CBr_2CHO\)

43. Which cycloalkane has the lowest heat of combustion per \(CH_2\) group?
   1) cyclopropane
   2) cyclobutane
   3) cyclopentane
   4) cyclohexane

44. The catalyst used in the preparation of an alkyl chloride by the action of dry \(HCl\) on an alcohol is
   1) anhydrous \(AlCl_3\)
   2) \(FeCl_3\)
   3) anhydrous \(ZnCl_2\)
   4) Cu

45. In the reaction
   \[ R - X \xrightarrow{\text{alcoholic}} \xrightarrow{\text{KCN}} A \xrightarrow{\text{dilute}} \xrightarrow{\text{HCl}} B, \]
   the product \(B\) is
   1) alkyl chloride
   2) aldehyde
   3) carboxylic acid
   4) ketone

(Space for Rough Work)
46. Which of the following compound would not evolve $CO_2$ when treated with $NaHCO_3$ solution?
   1) salicylic acid
   2) phenol
   3) benzoic acid
   4) 4-nitro benzoic acid

47. By heating phenol with chloroform in alkali, it is converted into
   1) salicylic acid
   2) salicylaldehyde
   3) anisole
   4) phenyl benzoate

48. When a mixture of calcium benzoate and calcium acetate is dry distilled, the resulting compound is
   1) acetophenone
   2) benzaldehyde
   3) benzophenone
   4) acetaldehyde

49. Which of the following does not give benzoic acid on hydrolysis?
   1) phenyl cyanide
   2) benzyol chloride
   3) benzyl chloride
   4) methyl benzoate

50. Which of the following would undergo Hoffmann reaction to give a primary amine?

$$\begin{align*}
&O \\
&\| \\
&1) \text{ } R-C-Cl \\
&2) \text{ } RCO\text{NHCH}_3 \\
&3) \text{ } RCO\text{NH}_2 \\
&4) \text{ } RCOOR
\end{align*}$$

(Space for Rough Work)
51. Glucose contains in addition to aldehyde group
   1) one secondary OH and four primary OH groups
   2) one primary OH and four secondary OH groups
   3) two primary OH and three secondary OH groups
   4) three primary OH and two secondary OH groups

52. A distinctive and characteristic functional group of fats is
   1) a peptide group
   2) an ester group
   3) an alcoholic group
   4) a ketonic group

53. At pH = 4 glycine exists as
   1) \( \text{H}_3\text{N}^+ - \text{CH}_2 - \text{COO}^- \)
   2) \( \text{H}_3\text{N}^+ - \text{CH}_2 - \text{COOH} \)
   3) \( \text{H}_2\text{N} - \text{CH}_2 - \text{COOH} \)
   4) \( \text{H}_2\text{N} - \text{CH}_2 - \text{COO}^- \)

54. Insulin regulates the metabolism of
   1) minerals
   2) amino acids
   3) glucose
   4) vitamins

55. The formula mass of Mohr's salt is 392. The iron present in it is oxidised by \( \text{KMnO}_4 \) in acid medium. The equivalent mass of Mohr's salt is
   1) 392
   2) 31.6
   3) 278
   4) 156

(Space for Rough Work)
56. The brown ring test for nitrates depends on
   1) the reduction of nitrate to nitric oxide
   2) oxidation of nitric oxide to nitrogen dioxide
   3) reduction of ferrous sulphate to iron
   4) oxidising action of sulphuric acid

57. Acrolein test is positive for
   1) polysaccharides
   2) proteins
   3) oils and fats
   4) reducing sugars

58. An organic compound which produces a bluish green coloured flame on heating in presence of copper is
   1) chlorobenzene
   2) benzaldehyde
   3) aniline
   4) benzoic acid

59. For a reaction $A + B \rightarrow C + D$ if the concentration of $A$ is doubled without altering the concentration of $B$, the rate gets doubled. If the concentration of $B$ is increased by nine times without altering the concentration of $A$, the rate gets tripled. The order of the reaction is
   1) 2
   2) 1
   3) $\frac{3}{2}$
   4) $\frac{4}{3}$

60. Which of the following solutions will exhibit highest boiling point?
   1) 0.01 M $Na_2SO_4_{(aq)}$
   2) 0.01 M $KNO_3_{(aq)}$
   3) 0.015 M urea$_{aq}$
   4) 0.015 M glucose$_{aq}$

(Space for Rough Work)